

Remarks

The Examiner has rejected Claims 2-6, 7, 8, 28-35 and 43-44 under 35 U.S.C. § 103(a) as being unpatentable over PCT WO 95/11642 (Feld, et al.) in view of U.S. Patent 6,222,970 (Wach, et al.) stating that all elements of the claimed invention are disclosed by Feld with the exception of the filter elements, which include the laser band pass filter, the laser rejection filter and the spatial filter.

In response, the Applicant has modified independent Claims 2, 22, 28 and 48 to include the limitation of a spatial filter which *restricts* the field of view of the coherent fiber bundle. These claims previously stated that the spatial filter *controlled* the angular field of view of the coherent fiber bundle. Support for the new limitation can be found on page 6 of the application at lines 3-9 which specifically states that "the spatial filter acts to restrict the angular field of view of the subsequent optical system" (i.e., the coherent fiber bundle).

The Applicant respectfully submits that the spatial filters of the type which restrict the field of view of the coherent fiber bundle are not disclosed by Wach and, in fact, that Wach teaches away from the use of such filters. In the device disclosed in Wach, the objective would be to collect as much of the scattered Raman light as possible to increase the efficiency of the probe in collecting and transmitting Raman emitted light. Wach states at column 3, lines 1-7:

Optical aspects of probe engineering require particular design finesse. The Raman affect involves very weak signals. Raman emissions may be one trillionth as intense as the exciting radiation. Subsequently, the probe must be incredibly efficient in collecting and transmitting Raman-emitted light.

The entire objective of the filtering methods disclosed in Wach are to increase the efficiency of the optical fibers in the collection of scattered Raman light. The filters used in Wach are clearly designed to provide wide acceptance angles at the tips of the fiber bundles. The Applicant refers the Examiner to column 34, lines 30-37 of Wach which state as follows:

Filtering may be accomplished in several manners. Interference filter coatings are applied directly to the fiber end face bundle. This technique requires difficult manufacturing procedures. It also suffers because the filters do not function well when light is incident at diverse angles; and, the probes ring filters are specifically designed for wide acceptance angles of light.

Wach then goes on to discuss several methods for filtering the light entering the ends of the probe.

This is in contrast to the objectives of the present invention. Chemical imaging requires a restricted field of view at the end of the coherent fiber bundle to preserve the spatial information arising from the Raman signals emanating from different points of the sample. The use of the spatial filter 28 in the present invention, which acts to restrict the angular field of view of the subsequent optical system, places limitations on the angular acceptance of the subsequent optics. The use of a lens of this type in any apparatus where Raman light is being collected is counter intuitive when taken in context of Wach because it is not obvious that further weakening the already weak Raman signal, which is the result of restricting the field of view, can be beneficial. The beneficial effects of restricting the field of view are only apparent when taken in the context of a chemical imaging application, which Wach does not discuss.

Thus, the Applicant respectfully submits that there is no motivation to apply the filters disclosed in Wach in combination with the fiberscope of Feld to create a chemical imaging fiberscope that can provide Raman chemical images wherein the spatial information is preserved. The Applicant further submits that the addition of the limitation of a spatial filter which restricts the field of view of the coherent fiber bundle is therefore not disclosed by the combination of Feld and Wach, et al. and that the Examiner's rejection of the claims under § 103(a) in view of the combination of Feld and Wach has been traversed.

With respect to Claims 3 and 29, the Examiner states that Wach teaches a laser band pass and a laser rejection filter which exhibit environmental insensitivity to temperature and humidity as described in various sections of columns 62-65 of Wach. These sections of Wach disclose thin film filters applied directly to the end face of the fibers via a high energy thin film deposition process. These types of filters are not utilized in the present invention. The present invention utilizes filters which are applied mechanically to the end of the coherent fiber bundle, typically having a quartz substrate upon which the filtering media has been applied. Wach specifically teaches away from the use of these types of filters, stating, at column 62, lines 40-47:

Previously, thin-film filters have been applied to wafers which were placed between fiber end faces mated in standard fiber optic connectors. This technique suffers from multiple drawbacks. 1) the assembly/fabrication process is difficult and expensive at best. 2) It is not conducive to the fabrication of micro-sized assemblies, such as are needed for biomedical applications as well as many other usages 3) Light diverges as it passes through the wafer's thickness; this leads to filtering and coupling inefficiencies. 4) The performance demands of low-light applications, such as Raman spectroscopy, *(as opposed to Raman chemical imaging)*, necessitates high-performance filtering, which are not compatible with this design architecture.

Emphasis added. Additionally, Wach, in these passages, is discussing neither laser bandpass filters nor laser rejection filters, but instead is referring to filters which are used to correct for interference generated as the light reflects off of the inside surface of the fiber as it propagates from one end of the fiber to another. No mention is made of laser bandpass or laser rejection filters in the cited portion of Wach.

To further distinguish the filters in use in the present invention from those disclosed in Wach, the Applicant has added the limitation that the laser bandpass and laser rejection filters have a temperature dependent bandshift coefficient of less than .005 nm per degree centigrade. Claims 3 and 29 have been modified to include this limitation. The inclusion of this limitation, especially when applied to laser bandpass and laser rejection filters, further distinguish the present invention from Wach.

With respect to Claims 8 and 34, the Examiner states that Wach teaches a band pass filter which is spatially patterned, having a first portion for filtering a laser light and a second transparent portion for transmitting scattering light at column 53, lines 9-22. The Applicant has reviewed this section of Wach and sees no reference to a spatially patterned filter having a filtering portion and a transparent portion and invites the Examiner to point out the specific reference to such a filter. The Applicant respectfully submits that these claims are patentable because they are not disclosed by Wach at the passage cited by the Examiner.

With respect to Claims 43 and 44, these claims have been cancelled and the limitation of a spatial filter has been incorporated into the independent claims and modified to read that the spatial filter **reduces** the field of view instead controlling the angular field of view, as discussed above.

With respect to Claims 6, 7, 33 and 34, regarding a window positioned at the end of the outer jacket approximate to sample, Wach specifically teaches away from the use of such a window in column 30, lines 6-9 which states as follows:

The application of the probe behind a window should be avoided due to the previously described negative aspects that windows impart. Environmental isolation is achieved by the application of various protective coatings.

Therefore, the Applicant respectfully submits that Claims 6, 7, 33 and 34 are patentable in light of the fact that Wach specifically teaches away from the claimed limitation of a window.


The Examiner has rejected Claims 18, 20-23, 25, 27, 45 and 47 under 35 U.S.C. § 103(a) as being unpatentable over the combination of Feld, Wach, et al. and further in view of an article

entitled "Liquid Crystal Tunable Filter Raman Chemical Imaging" by Treado, et al. The Applicant respectfully submits that these claims should be rendered patentable if their parent claims are deemed to be patentable by the Examiner by virtue of the amendments and remarks made herein.

Conclusion

The Applicant has modified various independent claims of the application to add limitations which distinguish it from the prior art. Specifically, Claims 2, 22, 28 and 48 have been modified to specify that the spatial filter positioned between the sample and the coherent fiber bundle restricts the field of view of the coherent fiber bundle, which distinguishes that filter from the one disclosed in Wach, which is designed to widen the field of view. In addition, limitations have been added to various dependant claims of the application, thereby rendering those claims patentable as well. Therefore, the Applicant respectfully submits that all currently pending claims of the application are in order for allowance and requests a Notice of Allowance for all currently pending claims at the earliest possible time.

Respectfully Submitted,



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